NEW SAXICOLOUS SPECIES OF *STRIGULA* Fr. (LICHENISED ASCOMYCOTINA: STRIGULACEAE) FROM AUSTRALIA AND NEW ZEALAND

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ABSTRACT

McCarthy, P.M. New saxicolous species of *Strigula* Fr. (lichenised Ascomycotina: Strigulaceae) from Australia and New Zealand. **Muelleria 8(3): 323–329 (1995).** — The saxicolous *Strigula australiensis* sp. nov. and *S. minutula* sp. nov. are described from Queensland, Australia, and *S. johnsonii* sp. nov. is described from the South Island of New Zealand. *Strigula australiensis* and *S. johnsonii* are unusual in that they have muriform ascospores.

INTRODUCTION

Species of *Strigula* have crustose thalli with *Cephaleuros* or *Trentepohlia* as the photobiont and perithecia that are characterised by simple or branched paraphyses, cylindrical, fissitunicate asci with a non-amyloid apex, a distinct ocular chamber and 1-septate to muriform ascospores. Conidiomata may be of two types and produce either minute, simple microconidia or larger, septate macroconidia. The latter usually have apical gelatinous appendages and their septation tends to mirror that of the ascospores.

Although most species are foliicolous in tropical and subtropical regions (Lücking 1992, Santesson 1952 and others), a comparatively small, but increasing number of corticolous and saxicolous taxa have been recognised (Harris 1975, Bricaud & Roux 1991, Purvis *et al.* 1992, Etayo 1993, Roux & Bricaud 1993, Canals *et al.* 1995). In Australasia, saxicolous specimens of *S. stigmatella* (Ach.) R. C. Harris were recently reported from eastern New South Wales (McCarthy 1993a) and Queensland (McCarthy 1994) and a calcicolous lichen from New Zealand, previously known as *Porina rhodinula* Zahlbr., was re-identified as *S. affinis* (Massal.) R. C. Harris (McCarthy 1993b).

The present contribution follows the collection of saxicolous specimens of *Strigula* in coastal areas of eastern Queensland and the South Island of New Zealand. Two of the three species described here are unusual in that they produce submuriform and muriform ascospores. Such septation is already known in a small number of non-foliicolous *Strigula* species including the North American, corticolous *S. submuriformis* (R.C. Harris) R.C. Harris (Harris 1973) and a southern European, calcicolous *species* (Canals *et al.* 1995).

THE SPECIES

Strigula australiensis P.M. McCarthy *sp. nov.*

Thallus epilithicus, continuus vel leviter rimosus, obscure pallido viridigriseus vel pallido griseobrunneus, (30–)60(–100) µm crassus. Algae *Trentepohlia*, 7–14 × 6–12 µm. Perithecia semiimmersa vel 2/3-immersa. Involucrellum (0.32–)0.44(–0.58) mm diametro. Paraphyses simplices vel leviter ramosae. Asci fissitunicati, cylindrici, 68–93 × 17–22 µm. Ascosporae submuriformes, (23–)29(–36) × (7–)9.5(–11.5) µm. Microconidia simplices, 2–3 × *c.* 0.8 µm. Macroconidia submuriformes, (19–)23.5(–30) × (6–)7.5(–9) µm.

Typus: Australia, Queensland, 13 km SE of Innisfail, 3 km NE of Mena, Utchee Creek, by Utchee Falls, 17°38′24″S, 145°56′19″E, on shaded semi-aquatic basalt, 12 Sep. 1993, *P.M. McCarthy 936* (Holotypus: MEL 1057469; Isotypus: BRI).

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Thallus crustose, epilithic, effuse to determinate, continuous to sparingly rimose, pale greenish-grey to pale grey-brown, smooth to minutely and irregularly uneven, matt, ecorticate, (30–)60(–100) µm thick. *Algae Trentepohlia*; cells broadly ellipsoid to globose, 7–14 × 6–12 µm. *Hyphae* 2–3 µm wide. *Prothallus* not apparent. *Perithecia* semi-immersed to 2/3 immersed, usually solitary, occasionally paired, moderately to very numerous. *Perithecial apex* plane or convex. *Ostiole* inconspicuous or in a shallow, 60–100 µm wide depression. *Involucrellum* greyish-black in surface view, brown-black to black in thin section, dimidiate or extending to excipulum-base level, (0.32–)0.44(–0.58) mm diam., 30–60 µm thick towards the apex, 60–90 µm thick at the base, K−. *Centrum* broadly ovate to depressed-ovate, 0.2–0.32 mm diam. *Excipulum* uniformly hyaline to very pale brown, 15–20(–25) µm thick. *Paraphyses* simple to sparingly branched (especially near their apices), not anastomosing, septate, long-celled, 1–1.5 µm thick; cells frequently guttulate. *Periphyses* absent. *Asci* fissitunicate, 8-spored, broadly to elongate-cylindrical, 68–93 × 17–22 µm; lateral walls *c.* 1 µm thick; apex rounded, 3–6 µm thick, with an ocular chamber 1–3 µm broad and 1–2 µm tall, convex to tuberculate; walls and apex IKI−; ascoplasma IKI+red-brown. *Ascospores* hyaline, elongate-ellipsoid to elongate-fusiform, submuriform, with 7–9(–11) transverse septa, each loculus with (0–)1(–2) longitudinal or diagonal septa, often with a 2–3 µm thick gelatinous sheath when immature, irregularly biseriate in the asci, (23–)29(–36) × (7–)9.5(–11.5) µm (91 measured). *Conidiomata* of two types: 1) 60–100 µm diam., black above, colourless below, with a simple conidiogenous layer and fusiform microconidia of 2–3 × *c.* 0.8 µm; 2) 0.19–0.24 mm diam., black above, colourless below, with narrowly cylindrical or narrowly ellipsoid, submuriform macroconidia of (19–)23.5(–30) × (6–)7.5(–9) µm, mostly with convex to acuminate, gelatinous appendages at their apices, growing obliquely from the tips of short, unbranched, *c.* 3 µm wide conidiophores. (Fig. 1).

Remarks

Strigula australiensis is characterised by moderately large perithecia and submuriform ascospores and macroconidia which, because they are broader than those of taxa described heretofore, are concomitantly more abundantly septate. Moreover, not only has the New Zealand taxon *S. johnsonii* larger perithecia, its ascospores are discontinuously longer and fully muriform (see below).

This lichen appears to be confined to shaded basalt and granite in warm-temperate and tropical rainforest in eastern Australia. It has been collected in two localities in south-eastern Queensland and in the north-east of the state on and below the Atherton Tableland. This disjunction corresponds with one of climate and land-use in the central coastal region of Queensland between latitudes 26°S and 21°S. Thus the Great Dividing Range dissipates, precipitation is lower, agriculture is more intensive and rainforest all but disappears. Above latitude 21°S, however, the coastal areas are more mountainous and, thus, topography together with heavy summer rains support rainforest and its associated lichens.

Additional Specimens Examined

Queensland — Lamington National Park, Green Mountains, near Border Track, above Elabana Falls, Canungra Creek, on semi-aquatic basalt, 4 Sep. 1993, *P.M. McCarthy 733* (MEL 1057466); Bunya Mountains National Park, just above Paradise Falls, on dry shaded rocks beside creek, 5 Sep. 1993, *P.M. McCarthy 771* (MEL 1057468); Atherton Tableland, 30 km WSW of Innisfail, Palmerston National Park, below Tchupala Falls and above Wallicher Falls, tributary of North Johnstone R., on dry shaded basalt, 10 Sep. 1993, *P.M. McCarthy 815B* (MEL 1057471); Atherton Tableland, Bellenden Ker Range, 6 km W of Babinda, Babinda Creek, The Boulders, on shaded granite beside creek, 12 Sep. 1993, *P.M. McCarthy 909* (MEL 1057473).

Strigula johnsonii P.M. McCarthy *sp. nov.*

Thallus epilithicus, continuus vel leviter rimosus, nitidus, argenteogriseoviridis, (30–)50–80(–100) µm crassus. Algae *Trentepohlia*, (6–)8–15(–20) × (6–)8–13(–16) µm. Perithecia semiimmersa vel immersa. Involucrellum (0.42–)0.6(–0.82) mm diametro. Paraphyses simplices vel leviter ramosae. Asci fissitunicati, cylindrici, 110–160 × 28–38 µm. Ascosporae muriformes, fusiformes vel elongatae-fusiformes, (37–)49(–63) × (10–)15(–19) µm. Conidia non vidi.

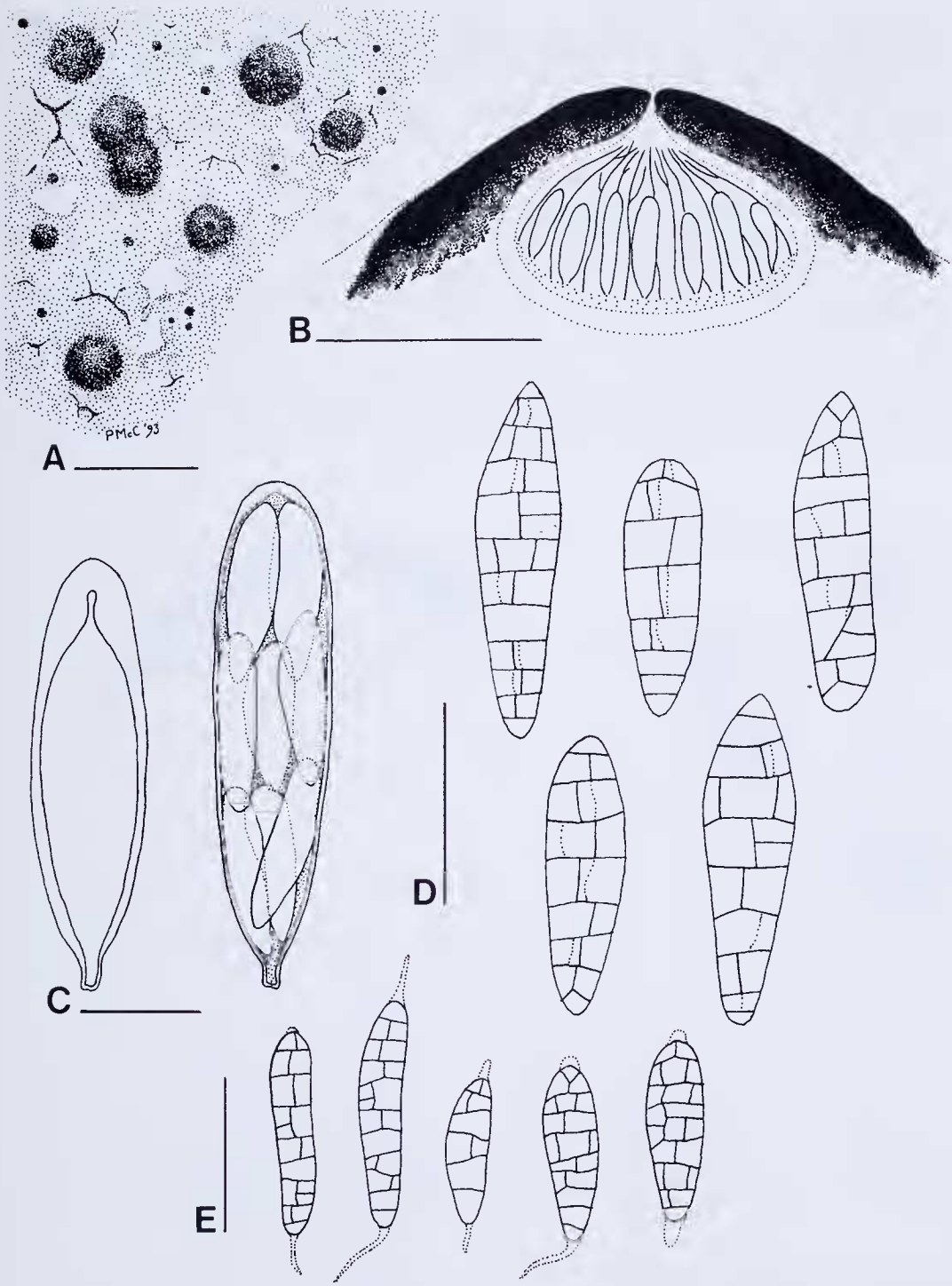

Fig. 1. *Strigula australiensis* (a-d, holotypus; e, MEL 1057471). a — habit of thallus, perithecia and conidiomata; scale 1 mm. b — vertical section of perithecium; scale 0.2 mm. c — immature and mature asci. d — ascospores. e — macroconidia; scales c-e 20 µm.

TYPUS: New Zealand, South Island, North Otago, Leith Valley, below Morrisons Creek, on rounded volcanic stones in bank of flood-prone stream, 30 June 1993, *P.N. Johnson 757* (HOLOTYPUS: CHR 494632; ISOTYPUS: MEL 1057470).

Thallus crustose, epilithic, continuous to sparingly rimose, pale silvery greyish green, smooth to minutely uneven, glossy to dull (older thalli), (30–)50–80(–100) µm thick. Although lacking a cortex, the uppermost *c.* 10 µm is free of algae. *Hyphae* 2–3 µm wide. *Algae Trentepohlia*; cells broadly ellipsoid to globose, (6–)8–15(–20) × (6–)8–13(–16) µm. *Prothallus* not apparent. *Perithecia* semi-immersed to almost entirely immersed, moderately numerous, usually solitary. *Perithecial apex* rounded or subconical. *Ostiole* inconspicuous or in a shallow, 60–100 µm wide depression. *Involucrellum* brown-black, dimidiate or extending to excipulum-base level, (0.42–)0.6(–0.82) mm diam., 50–100 µm thick, K−. *Centrum* broadly ovate to depressed-ovate, 0.28–0.44 mm diam. *Excipulum* uniformly hyaline in thin section, 20–30(–35) µm thick. *Paraphyses* persistent, simple to very sparingly branched, not anastomosing, septate, 1–1.5(–2) µm thick. *Periphyses* absent. *Asci* fissitunicate, 8-spored, cylindrical, 110–160 × 28–38 µm; lateral walls *c.* 1 µm thick; apex rounded, 3–6(–8) µm thick, with an ocular chamber, 3–5 µm broad and 1–2 µm tall, convex to hemispherical; walls and apex IKI−; ascoplasma IKI+red-brown. *Ascospores* hyaline, fusiform to elongate-

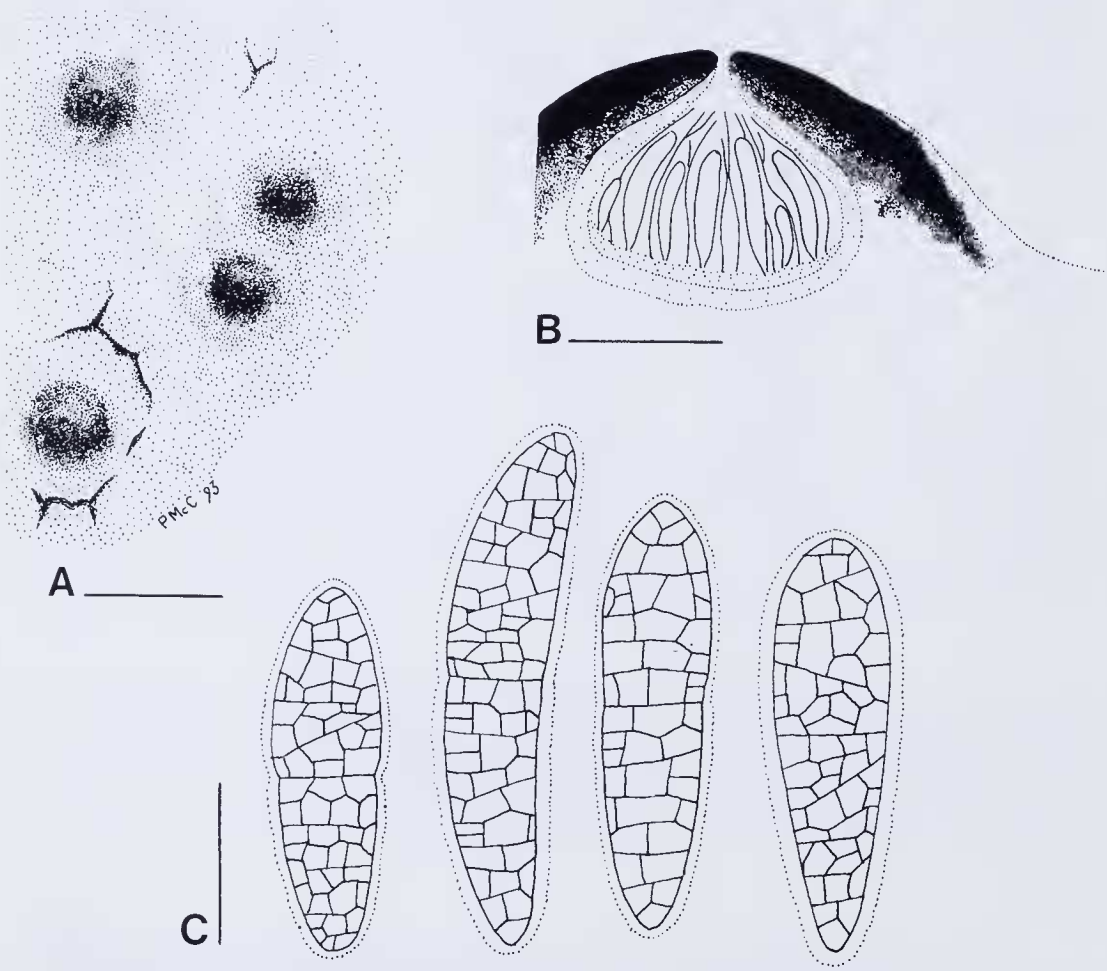

Fig. 2. *Strigula johnsonii* (isotypus). a — habit of thallus and perithecia; scale 1 mm. b — vertical section of perithecium; scale 0.2 mm. c — ascospores; scale 20 µm.

fusiform, muriform, with 10–17 transverse septa, each loculus with (1–)2–3 longitudinal or diagonal septa, with rounded or somewhat pointed apices and a (2–)3–4(–6) µm thick gelatinous sheath, irregularly biseriate in the asci, usually constricted at the primary septum, (37–)49(–63) × (10–)15(–19) µm (119 measured). *Conidiomata* not seen. (Fig. 2)

Remarks

Strigula johnsonii has a very pale, mainly glossy thallus, large perithecia and, most significantly, ascospores that are larger and more richly septate than those of any other species. It is named in honour of Dr Peter N. Johnson of Dunedin who, in recent years, has collected many interesting pyrenocarpous lichens in New Zealand.

This lichen inhabits shaded, seasonally-inundated rocks and is known from two localities in south-eastern New Zealand.

Additional Specimen Examined

New Zealand: *South Island* — North Otago, Bethunes Gully, below Mt Cargill, grid ref. I44/198837, alt. 135 m, on shaded volcanic boulders in flood-prone incised stream, 20 June 1993, *P.N. Johnson 732* (CHR, MEL 1057475).

Strigula minutula P.M. McCarthy *sp. nov.*

Thallus epilithicus, continuus vel leviter rimosus, pallidoviridis vel griseoviridis. Algae *Trentepohlia*, 5–10(–14) × 5–8 µm. Perithecia prominantia, thallo tecto. Involucrellum (0.15–)0.21(–0.28) mm diametro, 20–30(–40) µm crassum. Paraphyses simplices vel leviter ramosae. Asci fissitunicati, elongati-cylindrici, 45–58 × 6–8 µm. Ascosporae 1-septatae, (6–)8(–10) × (2–)2.5(–3.5) µm. Macroconidia 1-septata, 4.5–7.5 × 2–2.5 µm.

Typus: Australia, Queensland, Bunya Mountains National Park, between Paradise Falls and Little Falls, 26°52′S, 151°35′E, on deeply shaded aquatic and semi-aquatic rocks, 5 Sep. 1993, *P.M. McCarthy 759* (Holotypus: MEL 1057467; Isotypus: BRI).

Thallus crustose, epilithic, determinate, continuous to sparingly rimose, pale green to dark grey-green, often slightly darker near the margin, smooth, somewhat glossy, ecorticate, (25–)40(–60) µm thick. *Algae Trentepohlia*; cells broadly ellipsoid to subglobose, 5–10(–14) × 5–8 µm. *Hyphae* 2–3 µm wide. *Prothallus* not apparent. *Perithecia* very numerous, prominent, but partly or almost entirely overgrown by a (10–)15–25(–30) µm thick thalline layer, usually solitary, hemispherical, subglobose or subconical. *Ostiole* usually inconspicuous. *Involucrellum* brown-black, extending to excipulum-base level, (0.15–)0.21(–0.28) mm diam., 20–30(–40) µm thick, K−. *Centrum* broadly ovate to subglobose, 0.08–0.17 mm diam. *Excipulum* medium to dark brown, 10–15 µm thick. *Paraphyses* simple to sparingly branched, c. 1 µm thick. *Periphyses* absent. *Asci* fissitunicate, 8-spored, elongate-cylindrical, 45–58 × 6–8 µm; lateral walls c. 1 µm thick; lateral walls and apex IKI−; apex rounded, 2–3 µm thick, with a 1–2 µm broad and 1–2 µm tall, convex to tuberculate ocular chamber; ascoplasma IKI+red-brown. *Ascospores* hyaline, elongate-ellipsoid to elongate-fusiform, 1-septate, more-or-less uniseriate in the asci, (6–)8(–10) × (2–)2.5(–3.5) µm (50 measured). *Conidiomata* 80–130 µm diam., black above, pale to dark brown below, with a simple conidiogenous layer of 12–20 × 1 µm hyphae. *Macroconidia* 1-septate, elongate-ellipsoid to cylindrical, 4.5–7.5 × 2–2.5 µm, growing obliquely from the tips of short, unbranched conidiogenous hyphae, with variously developed, apical gelatinous appendages. *Microconidia* not seen. (Fig. 3)

Remarks

The thallus of *S. minutula* is comparatively dark and the very small perithecia are at least partly covered by a thalline layer and contain elongate-cylindrical asci with extremely small, 1-septate ascospores. Even smaller macroconidia are also produced. The diminuitive ascospores set this lichen apart from most other *Strigula* species, its novelty being confirmed by the overgrowth of the perithecia by a thalline layer and its unusual habitat.

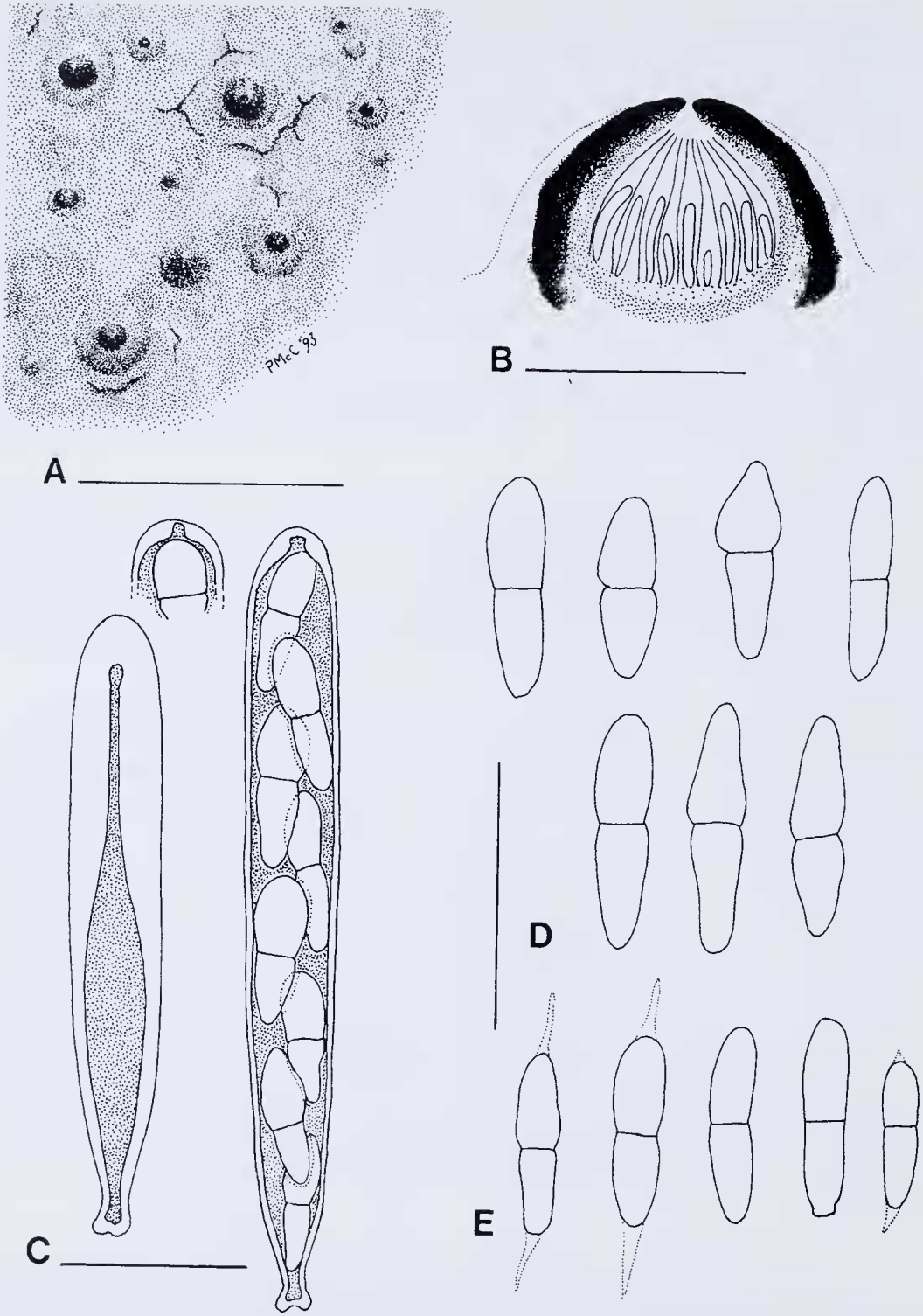

Fig. 3. *Strigula minutula* (holotypus). a — habit of thallus, perithecia and conidiomata; scale 1 mm. b — vertical section of perithecium; scale 0.2 mm. c — ascospores. d — immature and mature asci. e — macroconidia; scales c-e 10 μm.

The new lichen is represented by a large, fecund collection from deeply shaded aquatic rocks in rainforest in south-eastern Queensland. The Bunya Mountains are a compact and lichenologically remarkable region, dominated by upland rainforest and surrounded by intensively farmed plains. The aquatic and adjacent saxicolous lichen floras are exceptionally diverse and include *Clathroporina eminentior* (Nyl.) Müll. Arg., *Hymenelia lacustris* (With.) Choisy, *Strigula australiensis* P.M. McCarthy, *Anisomeridium sp.*, and *Staurothele pallidopora* P.M. McCarthy, and at least four aquatic *Verrucariae*.

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REFERENCES

Bricaud, O. & Roux, C. (1991) *Strigula calcarea* Bricaud et Roux sp. nov., espèce nouvelle de lichen. *Bull. Soc. Linn. Provence* 42: 131–140.

Canals, A., Boqueras, M. & Gómez-Bolea, A. (1995) *Strigula porinoides* sp. nov. (Ascomycetes, Lichenes) from the karstic regions. *Mycotaxon*: In Press.

Etayo, J. (1993) *Strigula mediterranea*, a new name for the forgotten lichen *Porina schizospora*. *Lichenologist* 25: 257–260.

Harris, R. C. (1973) The corticolous pyrenolichens of the Great Lakes Region. *Michigan Bot.* 12: 3–68.

Harris, R. C. (1975) *A Taxonomic Revision of the Genus* Arthopyrenia *Massal.* s. lat. *(Ascomycetes) in North America*. (Ph.D. dissertation: University of Michigan.)

Lücking, R. (1992) Foliicolous lichens — a contribution to the knowledge of the lichen flora of Costa Rica, Central America. *Beih. Nova Hedwigia* 104: 1–179.

McCarthy P. M. (1993a) New records of pyrenocarpous lichens from Australia. *Muelleria* 8: 31–36.

McCarthy, P. M. (1993b) *Saxicolous Species of* Porina *Müll. Arg. (Trichotheliaceae) in the Southern Hemisphere*. (*Bibliotheca Lichenologica* 52). (Stuttgart & Berlin: J. Cramer.)

McCarthy. P. M. (1994) Additional lichen records from Australia. 19. *Australas. Lichenol. Newsl.* 35: 14–17.

Purvis, O. W., Coppins, B. J., Hawksworth, D. L., James, P. W. & Moore, D. M. (eds) (1992) *The Lichen Flora of Great Britain and Ireland*. (London: Natural History Museum Publications.)

Roux, C. & Bricaud, O. (1993) Studo de la genro *Strigula* (Lichenes, Strigulaceae) en S-Francio. Graveco de la makrokonidioj. *Bull. Soc. Linn. Provence* 44: 117–134.

Santesson, J. (1952) Foliicolous lichens I. A revision of the taxonomy of the obligately foliicolous, lichenized fungi. *Symb. Bot. Upsal.* 12(1): 1–590.

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